APPLICATION

FOR

UNITED STATES OF AMERICA

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SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that I,

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have invented certain improvements in

"METHOD FOR PRODUCING A FABRIC-ELASTOMER SANDWICH AND SANDWICH OBTAINED THEREBY"

of which the following description in connection with the accompanying drawings is a specification, like reference characters on the drawings indicating like parts in the several figures.

BACKGROUND OF THE INVENTION

The present invention relates to a method for producing a fabric-elastomer sandwich and to the sandwich obtained thereby.

It is known that sandwiches made of a fabric and an elastomer, particularly vulcanized and non-vulcanized rubber, obtained by applying at least one elastomeric layer to a fabric, are already commercially available.

Spreading, calendering, spraying and immersion techniques are widely used to produce such sandwich in order to obtain continuous bonding between the fabric and the elastomer, which can be polyurethane, polyvinyl chloride, polyolefins, rubber latexes, acrylic or polyurethane resins, synthetic or natural rubbers, and so forth.

The above cited techniques only allow to provide continuous sandwiches, i.e., sandwiches having one side uniformly covered by a continuous layer of elastomer.

By using conventional pressure-molding methods it is possible to vary the thickness of the elastomeric region in different areas, reproducing even complicated patterns which are nonetheless continuous over the entire side of the fabric.

With microinjection distribution methods (using for example liquid polyurethanes) it is possible to obtain surfaces having separate regions, but is not possible to control exactly the thicknesses, shapes and dimensions of the individual elastomeric regions.

While continuity provides uniformity of properties, it is however a real limitation to the development of preformed anisotropic components, which are required for specific applications in several fields, such as clothing, luggage, shoes and in the technical sports field in general.

With currently available techniques, since essentially continuous layers of elastomer are obtained, it is not possible to combine the typical properties of fabric, such as lightness, flexibility, soft texture and breathability, with the typical properties of elastomeric materials, such as protection against

impacts, resistance to abrasion and tearing, antislip properties, impermeableness and so forth.

SUMMARY OF THE INVENTION

The aim of the present invention is to solve the above mentioned problems, by providing a method for obtaining a fabric-elastomer sandwich in which the elastomer is organized, on at least one of the two sides of the fabric, into separate regions whose thickness, shape and dimensions are selected at will and which, besides improving the aesthetic appearance of the sandwich, allow to perform a considerable number of functions, ranging from protective action to antislip characteristics and so forth, without eliminating properties being peculiar to fabric, such as flexibility, soft texture, breathability, et cetera.

Within this aim, an object of the present invention is to provide a method which allows to obtain a sandwich in which at least one side has only some regions of elastomer which is dosed as regards position and quantity according to criteria which can be easily determined in advance, so as to have regions with elastomer alternated with regions completely free of elastomeric material.

Another object of the present invention is to provide a method which allows to obtain sandwiches which can be used in the most disparate sectors, such as shoes, clothing, luggage, in the technical sports field, and in any field requiring products having antislip properties.

Another object of the present invention is to provide a method which allows, by way of a succession of extremely quick and simple steps, to obtain a sandwich which is particularly versatile and capable of assuming the characteristics deemed appropriate for the specific applications.

This aim and these and other objects which will become better apparent hereinafter are achieved by a method for producing a fabric-elastomer sandwich, according to the present invention, characterized in that it consists in providing a fabric with at least minute gaps between its fibers, in

placing such fabric on a mold having at least resting portions for the fabric and at least regions which are recessed with respect to the resting portions, in applying an elastomer to the side of the fabric that lies opposite to the side directed towards the mold, in applying pressure to make the elastomer flow through the minute gaps located at the recessed regions in order to fill such recessed regions with the elastomer, and in extracting the sandwich from the mold.

BRIEF DESCRIPTION OF THE DRAWINGS

Further characteristics and advantages of the present invention will become better apparent from the detailed description of a preferred but not exclusive embodiment of a method for producing a fabric-elastomer sandwich and of the resulting sandwich, given with the aid of the accompanying drawings, wherein:

Figure 1 is a schematic view, in the open position, of the mold for producing a sandwich having regions made of elastomeric material on one side and a continuous layer of elastomeric material on the opposite side;

Figure 2 is a view of the mold of Figure 1 in the closed position;

Figure 3 is a sectional view of the resulting sandwich;

Figure 4 is a perspective view of the resulting sandwich;

Figure 5 is a sectional view of a sandwich with a separable continuous elastomeric layer;

Figure 6 is a layer-by-layer view of the separation layer for removing the elastomeric layer;

Figure 7 is a schematic perspective view of a portion of a sandwich constituted by a fabric which has regions made of elastomeric material on a single side.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the figures, the method for producing a fabric-elastomer sandwich is based on the use of a fabric 1 which has a particular weave, so that minute gaps or interspaces remain between the weft and the

warp and are adapted to allow an elastomeric material to pass through them.

In order to control the passage of the elastomeric material, a mold 10 is provided which has resting portions 11 on the face directed toward the fabric 1; such resting portions are usually but not necessarily flat, and recessed regions 12 are provided between them; the recessed regions are mutually separate, they can reproduce any pattern deemed appropriate and have any depth.

In practice, the mold constitutes a surface for contact with the fabric interspersed with recessed regions of any depth and shape.

The elastomeric material is applied to the side of the fabric that lies opposite the side directed towards the mold, and by using a suitable pressure and temperature the elastomeric material flows through the fabric, passing through the interspaces or minute gaps, until it fills the recessed regions.

The peculiarity of the invention consists in that the elastomeric material passes through the fabric only in the recessed regions but is unable to flow at the regions or portions where the fabric rests.

According to a preferred embodiment, a sheet-like element which forms a layer of elastomer, designated by the reference numeral 20, and is arranged on the side of the fabric is provided for the application of the elastomeric material; a counter–mold 30 is also provided which must be shaped so as to mate perfectly with the resting portions 11 without mating with the recessed regions.

As shown in Figures 1 to 4, once the mold has been closed, pressures and temperatures capable of liquefying the elastomer are applied; the elastomer is made to flow through the fabric 1 in order to obtain a sandwich which has, on one side, a continuous layer of elastomeric material which corresponds in practice to the layer 20 and, on the other side, regions of elastomer which are located at the recessed regions 12, with the possibility to reproduce any fineness of pattern, providing a plurality of mutually separate regions arranged in any manner or configuration.

If one wishes to obtain a sandwich simply constituted by a layer of fabric 1 provided with the regions of elastomeric material, designated by the reference numeral 20a, only on one side, a separation layer 40 is interposed between the elastomeric material in layer form 20 and the fabric 1.

The separation layer is typically provided by a film which is capable of withstanding the process conditions, i.e., a film which is not destroyed, melted or completely modified at the temperatures that are used, but instead breaks selectively, due to the pressures involved, at the recessed regions of the mold in order to allow the elastomer to flow through the fabric.

The most commonly usable films are constituted by films of non–oriented nylon 6, nylon 6.6 and PET, with a thickness between 10 and 40 microns, and in mono- or biaxially oriented form, with a thickness between 5 and 25 microns.

Once the elastomeric material has been molded, as shown schematically in Figure 5, it is possible to separate the continuous layer of elastomeric material, thus obtaining a fabric which has the elastomer regions 20a only on one side.

In the practical applications, it is possible to obtain sandwiches which have a continuous layer on one side and separate regions of elastomer on the other side, or it is possible to provide a sandwich constituted by a fabric which has a completely free side and elastomer regions on the other side; it is further possible to provide elastomer regions on both sides of the fabric, in which case the counter–mold must have recessed regions which correspond to the elastomer regions on the other side.

Various kinds of fabric that have the particular characteristic of having, between the fibers or anyhow between the weft and warp, minute gaps or interspaces which allow the elastomer to pass when pressure is applied, can be used to perform the process.

The materials used can be synthetic, such as nylon and polyester, optionally reinforced with aramid fibers, or natural materials, such as cotton

and linen.

Dyes and finishes may be resistant or not to the conditions for bonding with the elastomer, depending on whether one wishes to maintain the original appearance of the fabric or is interested in particular color change effects.

The elastomer is typically used in the form of a film or calendered sheet of preferably but not necessarily constant gauged thickness, in an amount sufficient to fill the pattern of the mold. The greater the thickness of the pattern to be reproduced, the thicker the calendered sheet that must be used in order to ensure filling.

It should also be specified that instead of using the elastomer in the form of a calendered layer it is possible to use, for example, a deposition of material directly in the molding press or to perform injection with an injection press in a cold mold, without departing from the concept of the solution idea consisting in providing the flow of the elastomer through the fabric, so as to produce mutually separate elastomer regions, on at least one side thereof.

The choice of the type of elastomer, once the type of sandwich to be produced has been determined, depends on the final properties that the pattern requires and on the type of fabric used.

The rheological properties of the elastomer used are very important for controlling the passage of the elastomer through the fabric if the weave of the fabric, the machine used and the selected process conditions remain the same. Such rheological properties in fact determine the tendency of the elastomer to pass or not in the various points of the fabric and therefore ultimately determine the control and the final result on the fabric. The more one wishes complete blocking of the elastomer in the contact regions, the more one must consider elastomers or formulations characterized by high viscosity in the process conditions, and vice versa.

By way of example, it is possible to use, as elastomers, mixtures based

on materials such as rubber, IR, BR, SBR, NBR, NR, EPDM, EVA and the like, and silicone rubbers or optionally TPU, TR, PVC and the like.

Still by way of example, it is noted that numerous recessed regions 12, which are e.g. star-shaped and are interspersed with other regions shaped like stylized octagons, were cutout as recesses in a plate-like mold in which the bottom is constituted by a flat contact surface.

The counter–mold 30 is formed by a flat plate which has no recessed regions and is adapted to provide a perfect seal in the points of the mold bottom that have no pattern.

Finish-free Cordura 1000, Cordura 500, Cordura 300 and Cordura 170 fabric, available on the market, were used.

Blends of rubber based on SBR and polybutadiene materials, allowing sulfur vulcanization and appropriately accelerated, were used as elastomeric element.

The rubbers were calendered so as to obtain a layer of approximately 2 mm.

A compression press with ground plates measuring 1000 x 750 mm and a closure pressure of approximately 600 tons was used to bond the rubbers to the fabrics.

The molding temperature conditions used ranged from 160 °C for 12-15 minutes to 175-180 °C for 6-8 minutes, depending on the mixtures and weaves used.

Ordinary releasing agents for rubber were provided on the mold and on the counter–mold.

In order to obtain the sandwich of Figure 4, the fabric was placed so as to cover the pattern of the mold and a layer of calendered material of the same size was superimposed; then pressure molding was performed according to the above described cycles, and after completing the vulcanization cycle the intended fabric-rubber sandwich was removed from the mold.

In order to obtain a sandwich of the type shown in Figure 7, a film of

non–oriented nylon 6 with a thickness of 25 microns was interposed between the fabric and the elastomeric layer. After performing the vulcanization cycle, the sandwich was removed and the rubber base was separated from the fabric by a slight pressure. The interposition of the film 40 between the fabric and the calendered material prevented the adhesion of the elastomeric material to the contiguous side of the fabric, thus allowing to obtain a fabric having a pattern with separate regions which are provided and bonded only on one side of the fabric.

In this manner, the fabric remains breathable in all the regions that are not covered by the regions of elastomeric material.

A breathable impermeable polyurethane osmotic membrane was then bonded which allows to obtain a breathable impermeable fabric which has a texture and a flexibility which can be compared to that of the original fabric but has distinctly superior resistance to abrasion and grip.

The same method allowed to produce a sole for a shoe.

In this case, a series of recesses which in practice reproduce the outer side of the sole was provided in the mold, and a continuous layer of elastomeric material was left on the other side, which constitutes the inner side in contact with the upper, forming in practice the load-bearing layer of the sole.

Fabrics such as Cordura 1000 and blends of the kind typically used for shoes, i.e., blends based on SBR and natural rubber, were used.

The sole was produced by way of pressure molding techniques, using molds designed as described above.

The vulcanization cycle applied lasted 7 minutes at temperatures of about 175 °C, with pressures of 400 tons.

From the above description it is thus evident that the invention achieves the intended aim and objects and in particular that the provision of a method which allows to achieve the passage of the elastomeric material through the fabric in preset regions allows to provide, on one side of the sandwich, a

freely selectable arrangement of regions of elastomeric material which are firmly bonded to the fabric and can give such fabric any selected technical properties.

The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

All the details may furthermore be replaced with other technically equivalent elements.

In practice, the materials used, as well as the contingent shapes and dimensions, may be any according to requirements.

The disclosures in Italian Patent Application No. MI2000A002753 from which this application claims priority are incorporated herein by reference.